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TRIANGULATION OF SOUTH AFRICA.

Geodetic Survey of South Africa. Vol. ii. *Report on a Rediscussion of Bailey's and Fourcade's Surveys and their Reduction to the System of the Geodetic Survey.* By Sir David Gill, K.C.B., LL.D., F.R.S., &c., H.M. Astronomer at the Cape. Pp. xx + 257. (Cape Town, 1901.)

THE Geodetic Survey of Cape Colony and Natal was carried out in the years 1883-92 by Colonel Morris, C.B., C.M.G., R.E., under the direction of Sir David Gill, and the results were published in the report issued in 1896.

The present volume is entitled vol. ii. of the Geodetic Survey, although, as Sir David Gill points out, its contents are not strictly of a geodetic character. As, however, many of the points are connected with stations of the Geodetic Survey, "with all the accuracy required for astronomical geodetic stations, it has been considered convenient to preserve the results in the same series of publications."

This vol. ii., then, is a discussion of the secondary triangulation carried out by Captain Bailey, R.E., in the years 1859-62, and of that executed by Mr. Fourcade, of the Forestry Department (in 1893?). These triangulations extend along the southern coast of South Africa from Cape Town to East London, a distance of about 550 miles, and have an average width of about 75 miles, covering an area of some 40,000 square miles. The probable error of an observed angle of Bailey's triangulation is about ± 2″·0; of Fourcade's, ± 0″·85. The number of points fixed is 133.

The history of the computation of Bailey's work is somewhat curious. In 1862 the Survey party embarked at Algoa Bay for England in a coasting steamer. The vessel struck upon the rocks off Struy's Point and became a total wreck. The original observation books were all lost. Fortunately, copies of abstracts of angles had been supplied to the Admiralty Surveyor, then at work on the Coast Survey, and other abstracts with a diagram had been sent to the Surveyor-General, to the Government of British Kaffraria, and to private individuals and surveyors, and from these a report was compiled by Captain Bailey and presented to the Cape Parliament in 1863. On the completion of the Geodetic Survey, however, it became obviously necessary to harmonise Bailey's work with the geodetic triangulation.

Throughout the length of the secondary work there are many sides which are common to it and the geodetic triangulation. The secondary triangulation has therefore been broken up into a number of small manageable figures. In these figures the number of equations of condition averages about ten, and in the reduction the geodetic triangulation is considered errorless, and its sides and angles enter as fixed quantities.

The net result is an important addition to the triangulation of South Africa. The volume is all the more valuable for the fact that the results of the Geodetic Survey (the report of which is now out of print) have been reprinted in the present report, which contains the whole of the accurate trigonometrical data in the Cape Colony and Natal which had been completed up to the year 1901. It may be hoped that the day is not far distant when this work will be used as the basis of the much-needed, long-delayed topographical survey.

Sir David Gill ends his preface with a remark which several national surveys might take to heart with advantage:—

"It is also of supreme importance that regular inspection of the Survey beacons should be instituted, and steps taken to provide for their repair and maintenance . . . it is most necessary in the public interest that these invaluable land-marks, which have cost so much in labour, skill and care to establish, should in future be more carefully preserved."

It may be noted that this is a duty which in India has long been recognised and carried out by the Government.

C. F. CLOSE.

VITALITY.

Religio Medici, &c. By a Student of Science and Medicine. Pp. viii + 216. (London: Good and Co., 1902.)

THE reader of this book is at first sight beset by two prejudices; the title, as printed on the back of it, "Religio Medici," is one which a great writer has made his own, a writer whose weight and intensity stand in contrast with the diffuseness and repetition of the present author; and secondly, the type is so small and defective that the labour of perusal is out of all proportion, so the reviewer is apt to think, to the value of the contents. A distant imitation of Sir Thomas Browne's conciseness would have halved these contents, at least; and thus reduced the cost of production by means better than inferior print. At the hundredth page our eyes gave out; but, after a glance at the remainder, we think in the first moiety one may read the whole.

The main purpose of the author is, by an argument which is similar to that of Dr. Lionel Beale, if not identical with it, to assert that "vitality" or "life power" belongs to the spiritual as opposed to the physical or material category, the realm of life being separate from the realm of matter. The end or purpose of this argument is not, of course, to be flouted because it cuts at the root of modern conceptions from which such entities have been dismissed; nay, even if the author regards force as something acting upon matter, as a bellows upon sand, it does not become us to throw his book aside because we have outgrown or parted company with such opinions. Evidently the author is not only an earnest and high-minded thinker, but also an accomplished scientific observer. His skill in the use of the microscope and its methods is probably considerable. But, while our minds are open and our respect for the writer is great, before we occupy our space with so vast a discussion we must have reasonable expectation of getting close to the points of issue. Of this approximation we see little hope. In the first place, it is inconceivable that modern conceptions will ever be put on the shelf that older opinions may be taken up again in their former

shape. Modern conceptions will, we trust, give way to others larger and better; in this author and reviewer are at one: yet their supersession will be by no such repentance, but by a wider and richer synthesis in which, no doubt, earlier and later opinions will find their reconciliation. To throw new ideas aside just to pick up certain old ones which, in substantially the same form, have prevailed and then lost their ascendancy, is what in the history of ideas has never happened, and, it is safe to say, never will happen. Secondly, to remodel our conceptions of life the thinker must not only be equipped, as no doubt the author is equipped, with skill in certain processes of research, but he must be equipped also with a philosophic grasp and penetration of which we see little evidence here. Besides the diffuse, reiterating and even rambling way of dealing with the subject on which we have animadverted, the author has neither rigidly defined his terms (such as "physical," "mechanical," &c.) nor repeated them even in approximately identical senses. Slovenly argument and confusion of language can only lead into the desert.

The author deprecates rash speculation; no speculation can be more ambitious than his, and it is none the less so for being elderly and familiar. The doctrines of the survival of the fittest may be "ingenious and fanciful," but his own are no less audacious and stand on supports at least as fragile.

In conclusion, we must content ourselves with pointing out that vital phenomena depend upon causes either of like nature to those which are in action in heat, light, chemical affinity and so forth, or they depend upon some intrusive entity of alien origin. The author holds the latter opinion. We must invite those who hold this opinion to explain whether in their hypothesis those which we will call the natural forces are superseded by the transcendental or not? So far as our knowledge goes, they are converted, but neither superseded nor curtailed; yet in this case how are we to conceive of them as entering into any sort of combination with agents with which they have no affinity whatsoever?

OUR BOOK SHELF.

Elements of Physics. By C. Henderson, Ph.D., and John F. Woodhull, Ph.D. Pp. x + 388; with illustrations and portraits.

Physical Experiments. By John F. Woodhull, Ph.D., and M. B. van Arsdale. Pp. iv + 112. (London: Hirschfeld Bros., Ltd., 1902). Price 5*s.* net bound together.

IT is to be feared that the former of these books (which are bound together) must be condemned if only for the astounding way in which optical images are considered. The image in a concave mirror is taken as being at the same distance behind the mirror as the object is in front, "because this seemed to be as reasonable as any other conclusion and it is a convenient measurement." This rule makes the image curved, and thus its distortion is explained. Even the usual inverted image is placed and its magnitude determined in accordance with the above rule. Extraordinary statements such as these in the chapter on light make it impossible to recommend that the book be placed in the hands of school children, for whom it is intended. The other portions are not affected with such general misconceptions, although they are not wholly free from serious error. Thus on p. 262 it is stated that a 32 c.p. lamp requires twice the current of a 16 c.p. lamp, and that this may be obtained either by doubling the voltage or halving the resistance. "In any case the heat and light will be proportional to the amount of current which passes." On p. 205, in connection with latent heat, "Farmers understand this and put tubs of water in their vegetable cellars on a cold night so that if the temperature falls below 32° F. the freezing of the water will give out such quantities of heat as shall prevent the temperature from falling far below 32°."

These mistakes are to be regretted the more because the authors appear to have striven to give, and in many cases have succeeded in giving, a lucid introductory account of the many phenomena dealt with.

The experimental book contains a very good selection of experiments for school use. The discription given is too brief except as a general guide to the teacher.

A. W. P.

Types of British Plants. By C. S. Colman. Pp. xii + 238. (London: Sands and Co., 1902.) Price 6*s.*

THIS is a volume which is intended to attract and teach the young naturalist. It presents a short general introduction, systematic and anatomical; it then traces out a developmental course, which begins with the simple unicellular algæ, works up through the more complex cryptogams and finally passes in review the principal phanerogamic orders. In addition, a few chapters are given up to special features, notably trees, parasites and insectivorous plants. Apart from the fact that no worse system could be adopted than that of placing before a beginner a number of facts loosely strung together, this book has the further disadvantage of starting with the lower plants, which are more difficult of comprehension and less suited to practical examination. The descriptions, too, of the lower plants, besides being so scrappy as to be valueless, are couched in ridiculous language. Why talk of "father pits" and "mother pits" in Fucus, or of a "nursery" in Vaucheria, or of "cheerful conviction" as applied to Phallus. A facetious mode of expression, which implies that plants possess the attribute of consciousness, runs through the book. Unfortunately, too many writers think that loose or facetious phraseology is necessary to make a book popular; it certainly detracts from the value of any scientific work.

Water-Supply. By Prof. William P. Mason. Third Edition, Rewritten. Pp. vii + 448. (New York; John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.)

THIS is the third edition of a work which has met with much appreciation both in this country and in America, for the writer is a recognised authority upon the subject with which he deals. Those who were familiar with the first two editions will note that in the present volume a considerable amount of new material has been added, and that the original chapters on "The Chemical and Bacteriological Examination of Water" have not been included—for the reason that they have been separately published.

There is nothing connected with water-supply—save engineering details of construction of water-works, &c.—on which this volume may not be consulted with value. The writer has an intimate knowledge of his subject, which has been gained by a wide experience. His information and experience is not limited to America, and the work is additionally acceptable to British readers from this circumstance—which is a somewhat exceptionable one among American writers of works dealing with sanitation.

The book is well printed and bound, and is very rich in excellent illustrations and diagrams.